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Electrical properties of epitaxial yttrium iron garnet ultrathin films at high temperatures

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Abstract

© 2018 American Physical Society. We report a study on the electrical properties of 19-nm-thick yttrium iron garnet (YIG) films grown by liquid phase epitaxy on gadolinium gallium garnet single crystal. The electrical conductivity and Hall coefficient are measured in the high-temperature range [300,400] K using a Van der Pauw four-point probe technique. We find that the electrical resistivity decreases exponentially with increasing temperature following an activated behavior corresponding to a band gap of Eg≈2 eV. It drops to values about 5×103Ωcm at T=400 K, thus indicating that epitaxial YIG ultrathin films behave as large gap semiconductors. We also infer the Hall mobility, which is found to be positive (p type) at 5 cm2V-1sec-1 and almost independent of temperature. We discuss the consequence for nonlocal spin transport experiments performed on YIG at room temperature and demonstrate the existence of electrical offset voltages to be disentangled from pure spin effects.

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